

CLAIMS

1. A servo drive system of a press machine comprising:
a ram;
an operation shaft which vertically moves the ram; and
5 a pair of servo motors which operate as power sources of the
ram and which composite and use torques based on the same
speed-torque characteristics, thereby generating necessary ram pressure,
wherein
the pair of servo motors are formed symmetrically with each
10 other in a mirror image manner,
the pair of servo motors are opposed to each other at opposite
ends of the operation shaft, and
the pair of servo motors are operated integrally so that the pair
of servo motors directly drive the operation shaft to vertically move the
15 ram.
2. The servo drive system according to claim 1, wherein
a power unit of a servo amplifier of one of the pair of servo
motors and a power unit of a servo amplifier of the other of the pair of
20 servo motor are driven by the same gate signal, thereby integrally
operating both the servo motors.
3. The servo drive system according to claim 1, wherein
the pair of servo motors use a torque based on speed-torque
25 characteristics of a motor, and
if a load is received from a work during a lowering operation of

the ram to generate necessary ram pressure without utilizing inertia of a mechanism, speeds of both the servo motors are reduced according to the load, thereby reducing the lowering speed of the ram.

5 4. The servo drive system according to claim 1, wherein
the operation shaft which vertically moves the ram comprises an
eccentric shaft, and
the eccentric shaft of the servo motor is formed as a motor main
shaft.

10

5. The servo drive system according to claim 4, wherein
sleeves each provided at its outer periphery with an even
number of magnetic pole magnets along a circumferential direction
thereof at predetermined distances from one another are fitted over
15 peripheries of left and right end extensions of the eccentric shaft,
thereby forming rotors of the pair of servo motors,

magnetic pole positions of the left and right sleeves are
positioned such that the sleeves are symmetric with each other in a
mirror image manner and the sleeves are fixed by bushes,
20 stators of the pair of servo motors have outer cylinders around

which three-phase armature windings are wound, and the outer
cylinders are respectively fitted over the rotors, and

the left and right outer cylinders are positioned such that
positions of the three-phase armature windings of the outer cylinders in
25 the circumferential direction are symmetric with each other in a mirror
image manner, and the outer cylinders are fixed to left and right

supporting frames of the eccentric shaft.

6. The servo drive system according to claim 4, wherein sleeves each provided at its outer periphery with an even
5 number of magnetic pole magnets along a circumferential direction thereof at predetermined distances from one another are fitted over peripheries of left and right end extensions of the eccentric shaft, thereby forming rotors of the pair of servo motors, .
positions of magnetic pole magnets of the left and right sleeves
10 in the circumferential direction are positioned such that the sleeves are symmetric with each other in a mirror image manner and the sleeves are fixed by bushes,
stators of the pair of servo motors have outer cylinders around which three-phase armature windings are wound, and the outer
15 cylinders are respectively fitted over the rotors, and
the left and right outer cylinders are positioned such that positions of the three-phase armature windings of the outer cylinders in the circumferential direction are symmetric with each other in a mirror image manner, and the outer cylinders are fixed to left and right
20 supporting frames of the eccentric shaft.

7. A servo drive system of a press machine which uses a servo motor as a driving source of a ram, wherein
the servo motor uses a torque based on speed-torque
25 characteristics of a motor,
necessary ram pressure can be generated without utilizing

inertia of a mechanism,

the system employs the servo motor in which if a load is received from a work during a lowering operation of the ram, motor speed is reduced according to the load, thereby reducing the lowering speed of the ram, and

the servo motor directly drives an operation shaft which vertically moves the ram.

8. The servo drive system according to claim 7, wherein

the operation shaft which vertically moves the ram comprises an eccentric shaft, and

the eccentric shaft of the servo motor is formed as a motor main shaft.

9. A servo drive system of a press machine which uses servo motors as driving sources of a ram, wherein

the servo motors are opposed to each other at opposite ends of an operation shaft which vertically moves a ram, and the servo motors composite and use torques based on the same speed-torque

characteristics,

necessary ram pressure can be generated without utilizing inertia of a mechanism, and the system employs a pair of servo motors in which if a load is received from a work during a lowering operation of the ram, motor speed is reduced according to the load, thereby

reducing the lowering speed of the ram, and

the pair of servo motors are integrally operated, thereby directly

driving the operation shaft.

10. The servo drive system according to claim 9, wherein
the operation shaft which vertically moves the ram comprises an
5 eccentric shaft, and
the eccentric shaft of the servo motor is formed as a motor main
shaft.

11. A continuous working system of a press machine which uses a
10 servo motor as a power source of a ram, wherein
an operation shaft which vertically moves the ram is directly
driven by using a servo motor which can generate necessary ram
pressure by using a torque based on speed-torque characteristics of a
motor, and
15 the operation shaft is continuously reciprocated and turned
through an angle range corresponding to a distance between a
predetermined lower end position required for press working by the ram
and a position where the ram is returned from the lower end position
and a lower end of the ram is separated from a tool upper surface such
20 that the ram vertically moves between these positions by the servo
motor, thereby subjecting a work to a continuous press working.

12. The continuous working system according to claim 11, wherein
the servo motor uses a torque based on the speed-torque
25 characteristics of the motor, and
the servo motor can generate necessary ram pressure without

utilizing inertia of a mechanism.

13. The continuous working system according to claim 11, wherein
the operation shaft which vertically moves the ram comprises an
5 eccentric shaft, and

the eccentric shaft of the servo motor is formed as a motor main
shaft.

14. A continuous working system of a press machine which uses
10 servo motors as power sources of a ram, wherein

a pair of servo motors are opposed to each other at opposite
ends of an operation shaft which vertically moves the ram, the servo
motors composite and use a torque based on the same speed-torque
characteristics so that the servo motors can generate necessary ram
15 pressure, and the operation shaft which vertically moves the ram is
directly driven by using the servo motors, and

the operation shaft is continuously reciprocated and turned
through an angle range corresponding to a distance between a
predetermined lower end position required for press working by the ram
20 and a position where the ram is returned from the lower end position
and a lower end of the ram is separated from a tool upper surface such
that the ram vertically moves between these positions by the pair of
servo motors, thereby subjecting a work to a continuous press working.

25 15. The continuous working system according to claim 14, wherein
the servo motors use a torque based on the speed-torque

characteristics of the motor, and

the servo motors can generate necessary ram pressure without utilizing inertia of a mechanism.

5 16. The continuous working system according to claim 14, wherein the operation shaft which vertically moves the ram comprises an eccentric shaft, and

the eccentric shaft of the servo motor is formed as a motor main shaft.

10

17. A servo drive system of a punch press which uses a servo motor as a power source of a ram, wherein

an operation shaft which vertically moves the ram is directly driven by using the servo motor which can generate necessary ram

15 pressure by using a torque based on speed-torque characteristics of a motor, and

the servo motor has a control power driver, the power driver being provided at its front stage with a reactor which suppresses peak current by cutting off high frequency current component, and a

20 capacitor which supplies electric energy which becomes short due to suppression of the peak current.

18. The servo drive system of a punch press according to claim 17, wherein

25 the capacitor supplies high speed operation electric energy and/or punching out electric energy which become short due to

suppression of the peak current.